EUV microexposures at the ALS using the 0.3-NA MET projection optics

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The recent development of high numerical aperture (NA) EUV optics such as the 0.3-NA Micro Exposure Tool (MET) optic has given rise to a new class of ultra-high resolution microexposure stations. Once such printing station has been developed and implemented at the ALS. This flexible printing station utilizes a programmable coherence illuminator providing real-time pupil-fill control for advanced EUV resist and mask development.

The Berkeley exposure system programmable illuminator enables several unique capabilities. Using dipole illumination out to s=1, the Berkeley tool supports equal-line-space printing down to 12 nm, well beyond the capabilities of similar tools. Using small-sigma illumination combined with the central obscuration of the MET optic enables the system to print feature sizes that are twice as small as those coded on the mask. In this configuration, the effective 10-demagnification for equal lines and spaces reduces the mask fabrication burden for ultra-high-resolution printing. The illuminator facilitates coherence studies such as the impact of coherence on line-edge roughness (LER) and flare. Finally the illuminator enables novel print-based aberration monitoring techniques as described elsewhere in these proceedings.

Here we describe the capabilities of the new MET printing station and present system characterization results. Moreover, we present the latest printing results obtained in experimental resists. Limited by the availability of high-resolution photoresists, equal line-space printing down to 25 nm has already been demonstrated as well as isolated line printing down to 32 nm with an LER of less than 3 nm.